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Confronting Health Effects of Particulate Matter in LCIA

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Published in:
Abstract book - SETAC Europe 24th Annual Meeting

Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

bioavailability in seawater. Taking into account the speciation behavior of metals in seawater and using effect data exclusively for marine organisms, two sets of spatially differentiated CFs were developed for the metals Cd, Co, Cu(II), Ni, Pb and Zn in coastal seawater. One set of CFs ($CF_{sw\text{-}sw}$) addresses the direct metal emission to coastal seawater while the other set ($CF_{fw\text{-}sw}$) represents the ecotoxicity potential of metals in coastal seawater caused by metal emission to freshwater followed by transport to the seawater compartment, taking into account the fate of metal in freshwater and in the estuary. CF is the product of three factors: Fate Factor (FF), Bioavailability Factor (BF), and Effect Factor (EF). The multimedia fate model of USEtox was used to calculate the FF. WHAM 7.0 was used to model metal speciation underlying the BF. Free Ion Activity Model (FIAM) was used to model EF. The results showed that for a given metal, FFin seawater was higher than in freshwater, due to longer residence time of the water in the coastal seawater than in freshwater. The difference between FF in seawater and freshwater was smaller since the difference in water residence time was partially neutralized by metal removal in estuaries. Metal BFs in seawater were similar or slightly higher than in freshwater due to the lower DOC and SPM concentration in seawater. For most metals, EFs were lower in seawater than freshwater, due to lower sensitivity of seawater biota to metals. As a general observation, $CF_{fw\text{-}sw}$ was lower than $CF_{sw\text{-}sw}$ due to metal removal in freshwater and estuary, but the difference was modest for most metals. For Pb , seawater CF were up to 1-4 orders of magnitude higher than freshwater CF. But for the other metals, seawater CFs were similar to freshwater CFs, indicating that the higher FF and BF in seawater were largely counterweighed by the lower EF for these metals. The variation of CFs in different coastal seawaters were up to ca. 2-3 orders of magnitude for one metal, indicating the importance of using spatial differentiated CFs. Compared with USES-LCA default $CF_{sw\text{-}sw}$, the new $CF_{sw\text{-}sw}$ were at least 3 orders of magnitude lower for all metals except Pb, of which USES-LCA $CF_{sw\text{-}sw}$ fall within the range of this study. This implied that for some metals, ecotoxicity CFs in coastal seawater might be overestimated in previous LCIA methods.

333 Confronting Health Effects of Particulate Matter in LCIA T.E. McKone, University of California / Sustainable Energy Systems Group; P. Fantke, Technical University of Denmark / IER; O. Jolliet, University of Michigan / School of Public Health. Ambient particulate matter (PM) is one of the most important environmental stressors contributing to the global human disease burden. However, there a lack of guidance on how to include health effects from PM exposure in the health footprint for life cycle impact assessment (LCIA). A task force was initiated to build a PM health impact framework and factors based on scientific consensus. Existing literature was reviewed and expert input was collected and discussed in an initial Guidance Workshop. Key scientific questions and challenges for quantifying health effects from PM exposure have been discussed and initial guidance and recommendations for the upcoming impact quantification process were developed. Preliminary recommendations address the general assessment framework, aspects to determine intake fractions (iF), and aspects to determine exposure-response factors (ERF) along with disease severity: These recommendations include: (1) the 2011 framework proposed by Humbert et al. (doi:10.1021/es103563z) provides an assessment starting point; (2) iF can be used as exposure metric with breathing rate linking ambient concentration and intake; (3) disability-adjusted life years without age-weighting and discounting can be used as a health metric; (4) population archetypes can account for aspects influencing intake fractions; (5) spatially-differentiated iF should be established for all archetypes with geographic differentiation further discussed; (6) emission-weighted iF are needed in all cases where emission and/or exposure conditions are unclear; (7) the 2010 Global Burden of Disease Study provides a useful starting point for calculating health effects; (8) compared to all-cause mortality, cause-specific mortality can provide a more informative basis an LCIA metric but age- and cause-specific disability weights need further analyses; (9) the need remains to discuss whether and how to consistently integrate non-linear exposure-response into LCIA; and (10) $PM_{2.5}$ can be used as indicator of the health risk associated with PM inhalation exposure. There is not sufficient evidence-based justification to differentiate between different primary/secondary PM sources or between different particle sizes regarding toxicity. Our study constitutes a first step towards arriving at recommendations for how to account for health effects of emissions of primary PM and secondary PM precursors in LCIA. However, a range of inconclusive aspects requires further analysis.

334 Using machine learning for human toxicity and freshwater ecotoxicity characterization of chemical emissions A. Marvuglia, CRP Henri Tudor / Resource Centre for Environmental Technologies CRTEResource Centre for Environmental Technologies CRTE; M. Kanevski, M. Leuenberger, University of Lausanne / Centre de recherche en environnement terrestre CRET; E. Benetto, CRP Henri Tudor / Resource Centre for Environmental Technologies CRTE. Toxicity characterization of chemical emissions is a complex task which usually proceeds via multimedia models attached to models of dose–response relationships to assess the effects on targets. Different models and approaches are available, but all require a vast amount of data on the properties of the chemical compounds being assessed, which are hard to collect or hardly available (especially for less common or newly developed chemicals). An example of such models is USEtox™, a consensual model for the characterization of human toxicity and freshwater eco-toxicity. The final aim of this work is building a data-driven model for chemical characterization from a limited amount of substance-specific data, complementary (and not alternative) to the existing assessment models. By focusing on Usetox™, and more specifically on the modelling of the fate factor (FF) from continental urban air to urban air ($FF_{airU,airU}$), for which data are available, this work makes a step ahead in that direction by pursuing two main objectives: 1) performing for the first time an extensive exploratory data analysis (EDA) of the input space containing substance-specific properties at the aim of detecting particular patterns in the data manifold; 2) exploring the modelling efficiency (for predicting toxicity) of a set of algorithms based on linear partial least squares (PLS) regression and on non-linear approaches: kernel PLS (KPLS), adaptive general regression neural networks (GRNN) and random forests (RF). The database available in USEtox™ wasused in this study. For the sake of simplicity, only the organic compounds have been taken into account here, to facilitate the development and testing of the approach pursued here, while not affecting the consistency of the outcomes and their applicability to the other compounds. Four main explanatory variables (degradation rate in air, degradation rate in water, Henry law coefficient at 25°C and partitioning coefficient between octanol and water) were identified in the input space. They are, therefore, the most important variables which have to be assessed with a high degree of accuracy. Current research efforts are addressing other parts of the model affected by important data gaps, e.g. to the calculation of human health effect factors. The presentation will focus on the results from non-linear algorithms and on the added value of the data-driven model for the LCA community as a whole and the toxicity assessment practice in particular.

335 Feedback from MAgPIE workshop - Environmental risk mitigation measures in risk assessment and management for P V. Poulsen, ANSES; A. Alix, Dow Agrosciences / Risk Management. A European workshop under the auspices of SETAC and European Commision was organised in order to provide European regulatory authorities a toolbox of risk mitigation measures designed for the use of Plant Protection Products for agricultural purposes. During the two workshops (one in Rome and one in Madrid) and due to their work in-between, stakeholders provided, for groundwater, surface water, in-field terrestrial and soil organisms, and off-field terrestrial organisms: - A summary of existing risk mitigation measures used in the different countries for regulatory purposes, - An analysis of these risk mitigation measures according to: their effciciency, their potential use in risk asessment, their practicallity of implementation for farmers, their practicallity of implementation from a regulatory point of view, - A collection of voluntary initiatives and stewardship programmes, - Feedback on experiences in risk management, - Identification of needs